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$$= \Sigma(\delta x-\delta x')^2 - \frac{1}{\Sigma x^2}[\Sigma x(\delta x-\delta x')]^2 - \frac{1}{\Sigma y^2}[\Sigma y(\delta x-\delta x')]^2$$

$$-\frac{1}{n}[\Sigma(\delta x-\delta x')]^2$$

Sum this again for a large number N of similar sets, then it is easy to show that $p_{x-x'}$, $p_{\delta o-\delta c}$ being probable errors

$$p^2_{x-x'}\left(1-\frac{3}{n}\right) = p^2_{\delta o-\delta c}$$

whence

$$p^2_x = \tfrac{1}{2}p^2_{x-x'} = \tfrac{1}{2}1\cdot00 \times \tfrac{8}{5} = {}''\cdot8$$

$$\therefore\ p_x = {}''\cdot9 \text{ nearly.}$$

This shows that my previous estimate was too low, and errors due to bad driving, &c., must have been more important than I thought.

This gives $p_\xi = 1''\cdot26$.

Finally the error of a deduced star place ($k' = \frac{1}{2}k$) $p' = 1''\cdot12$.

This is somewhat larger than the previous result. The error of the star place is accordingly slightly above, instead of slightly under, a second of arc.

The magnitude of p_ξ, as stated in the paper, is chiefly to be attributed to the accumulated error in the reductions. This arose through the use of an auxiliary angle, which was computed only to the nearest second.

A Dark Reticle. By Chas. S. Howe, Ph.D., Professor of Astronomy, Case School of Applied Science, Cleveland, Ohio (U.S.A.).

About a year ago it occurred to me that dark reticles might have some advantage over the ordinary reticles for transit circles and almucantars. During the past winter some experiments have been made to test their value. These reticles have been made of thin glass covered with some dark substance, and the lines have been cut through this substance to the surface of the glass. A number of experiments were made to find the best material to form the dark layer; it was finally decided to silver the glass. This has proved very satisfactory: fine, sharp lines can be cut in the silver, and if glass with a perfectly smooth surface has been selected, the star can be seen without any difficulty. The silver covers the centre of the glass only, so that the star can be seen when it comes into the field and until it reaches

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the reticle; then it disappears, but as it reaches each wire there is a flash of light and the chronograph key is tapped. For stars near the pole the light does not flash across the line, but lights it up gradually; the star finally comes into view, remains for an instant—hardly more than time enough to tap the key—and then slowly fades away. Some of the theoretical advantages of the new reticle are:—

1st. The probable error of tapping the key upon the flash would be less than upon the bisection of a star with a wire. With an ordinary reticle the eye and the mind of the observer are under a constant strain to determine when a star is bisected, or to estimate when it will be bisected. With the dark reticle the observer looks into a dark eyepiece, sees nothing, and does not try to see anything until the flash comes, when he strikes the key. Except in case of stars much fainter than are ordinarily observed, there is no difficulty in seeing the flash, and there is no strain upon the eye or upon the attention. It would seem, therefore, that the probable error of tapping the chronograph key would be less than in the old method.

2nd. The personal equation would be less for the reasons given above.

3rd. That part of the personal equation depending upon bright field or bright wires would be eliminated, because all stars would be observed with a dark field.

4th. Fainter stars could be observed, because no light would be lost from the bright field or bright wires.

After the observations mentioned in this article had been made it was found that a London firm of instrument makers was advertising in its catalogue a "flashing transit eyepiece" which seemed to be similar to the dark reticle described here. I have not, however, been able to find any record of observations made with it.

In order to test the probable error of tapping the key when the dark reticle was used, the method described in Chauvenet's *Practical Astronomy*, vol. ii. p. 194, was followed. The observations were made with the large almucantar of the Case Observatory.

Let $I =$ the observed interval between two wires for a star of declination δ.

Computed $i = I$ reduced to the angular distance between the same wires.

True $i =$ true angular distance between the same wires.

$r =$ probable error of the angular distance between two wires.

$\epsilon =$ probable error of tapping the key on one wire.

Then $r = \cdot 6745 \sqrt{\dfrac{[vv]}{m-1}}$, and $\epsilon = \cdot 6745 \sqrt{\dfrac{[vv]}{2(m-1)}}$.

46 *Leonis Minoris* observed 1902 March 13 gave the following results:—

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I	Computed t	True t	V.
s	s	s	
1·84	1·34	1·38	−·04
1·81	1·32	1·35	−·03
1·90	1·38	1·34	+·04
1·90	1·38	1·36	+·02
1·77	1·29	1·38	−·09
1·89	1·38	1·36	+·02
1·77	1·29	1·34	−·05
1·94	1·41	1·35	+·06

Thirty-five stars gave $[vv] = 1{\cdot}6427$, $m = 280$, and $\varepsilon = {}^{s}{\cdot}037$.

Twenty-two of these stars were time stars for which $\varepsilon = {\cdot}037$; the other thirteen were north of declination 70° and $\varepsilon = {\cdot}036$.

Thirty-five stars observed with the ordinary reticle gave $\epsilon = {\cdot}037$. Twenty-seven of these were time stars, and gave $\epsilon = {\cdot}036$; the remaining eight were north of 70° declination, and gave $\varepsilon = {\cdot}038$.

So far as the probable error of observation is concerned, there is then no difference between the two reticles. This probable error is undoubtedly made up of several components, but as the subject of this investigation was the comparison of the two reticles it is not necessary to separate them. No observations have yet been made to determine difference of personal equation. The greatest advantage of the dark reticle would seem to be in observations of *very* faint stars, for they would be observed in the same way as the other stars, whereas now they are observed with bright wires in a dark field.

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Observation of the Total Eclipse of the Moon, 1902 *April* 22, *at Perth Observatory, Western Australia.*

(*Communicated by W. Ernest Cooke, M.A., Government Astronomer.*)

The total eclipse of the Moon was observed here by Mr. Johns with a 10-inch refractor on 1902 April 22. The following phases were noted :—

	h m s	
Beginning of totality	6 10 47	G.M.T.
End "	7 35 14	"
Last contact with shadow ...	8 47 34	"

It was cloudy for first contact, and there were passing clouds during last, but at the times of the other observations it was